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भाग 2 आवधिक एवं सम्बद्ध दृष्टान्त

(दूसरा पुनरीक्षण)

Indian Standard

QUANTITIES AND UNITS

PART 2 PERIODIC AND RELATED PHENOMENA

(Second Revision)

UDC 53·081

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

June 1995 Price Group 4

Basic Standards Sectional Committee, MSD 1

NATIONAL FOREWORD

This Indian Standard (Second Revision) which is identical with ISO 31-2 : 1992 'Quantities and units — Part 2 : Periodic and related phenomena' issued by the International Organization for Standardization (ISO), was adopted by the Bureau of Indian Standards on the recommendation of the Basic Standards Sectional Committee (MSD 1) and approval of the Management and Systems Division Council.

The text of the ISO Standard has been approved as suitable for publication as Indian Standard without deviations. Certain conventions are, however, not identical to those used in Indian Standards. Attention is particularly drawn to the following:

a) Comma (,) has been used as a decimal marker while in Indian Standards the current practice is to use full point (.) as the decimal marker.

b) Wherever the words 'International Standard' appear referring to this standard, they should be read as 'Indian Standard'.

In this revised revision, the following changes have been made:

a) The decision by International Committee for Weights and Measures (CIPM) in 1980 concerning the status of supplementary units has been incorporated.

b) Units in use temporarily have been transferred to the column 'Conversion Factors and Remarks'.

c) The special remark on logarithmic quantities and units has been elaborated.

d) The unit 'Angstrom (A)' in use temporarily has been transferred to the column 'Conversion Factors and Remarks'

In the adopted standard, normative references appear to certain International Standards for which Indian Standards also exist. The corresponding Indian Standards which are to be substituted in their place are listed below along with their degree of equivalence for the editions indicated:

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
ISO 31-0 : 1992	IS 1890 (Part 0) : 1994 Quantities and units: Part 0 General principles (*first revision*)	Identical
IEC 27-1 : 1971	IS 3722 (Part 1) : 1983 Letter symbols and signs used in electric technology : Part 1 General guidance on symbols and subscripts (*first revision*)	Technically Equivalent

ADDITIONAL INFORMATION

IS 1890/ISO 31 consists of the following parts, under the general title 'quantities and units' :

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
ISO 31-1 : 1992	IS 1890 (Part 1) : 1995 Quantities and units: Part 1 Space and time (*third revision*)	Identical
ISO 31-2 : 1992	IS 1890 (Part 2) : 1995 Quantities and units: Part 2 Periodic and related phenomena (*second revision*)	Identical

(*Continued on fourth cover*)

AMENDMENT NO. 1 FEBRUARY 1997
TO
IS 1890 (PART 2) : 1995/ISO 31-2 : 1992
QUANTITIES AND UNITS
PART 2 PERIODIC AND RELATED PHENOMENA

(Second Revision)

(*Second cover page, National Foreword, last paragraph, first entry*) — Substitute 'IS 1890 (Part 0) :1995' *for* 'IS 1890 (Part 0) : 1994' in the second column.

(*Second cover page, National Foreword, last line, matter appearing in brace*) — Substitute *'third' for 'fourth'*.

(*Third cover page, National Foreword, second entry from top*) — Substitute the following for the existing matter:

ISO 31-4 : 1992	*IS 1890 (Part 4) : 1982/ ISO 31/4-1978 Quantities, units and symbols : Part 4 Heat (*first revision*)	Technically Equivalent

(*Third cover page, National Foreword, fourth entry from top*) — Substitute the following for the existing matter:

ISO 31-6 : 1992	†IS 1890 (Part 6) Quantities and units : Part 6 Light and related electromagnetic radiations (*first revision*)	Identical

(*Third cover page, National Foreword, last entry*) — Substitute the following for the existing matter:

ISO 31-13 : 1992	†IS 1890 (Part 13) Quantities and units : Part 13 Solid state physics (*first revision*)	Identical

(*Third cover, National Foreword*) — Insert the following matter at the end:

'*Under revision.

†Under print.'

(MSD 1)

Reprography Unit, BIS, New Delhi, India

Indian Standard

QUANTITIES AND UNITS

PART 2 PERIODIC AND RELATED PHENOMENA

(Second Revision)

1 Scope

This part of ISO 31 gives names and symbols for quantities and units of periodic and related phenomena. Where appropriate, conversion factors are also given.

2 Normative reference

The following standard contains provisions which, through reference in this text, constitute provisions of this part of ISO 31. At the time of publication, the edition indicated was valid. All standards are subject to revision, and parties to agreements based on this part of ISO 31 are encouraged to investigate the possibility of applying the most recent edition of the standard indicated below. Members of IEC and ISO maintain registers of currently valid International Standards.

IEC 27-1:1992, *Letter symbols to be used in electrical technology — Part 1: General.*

3 Names and symbols

The names and symbols for quantities and units of periodic and related phenomena are given on the following pages.

PERIODIC AND RELATED PHENOMENA — Quantities

Item No.	Quantity	Symbol	Definition	Remarks
2-1	period, periodic time	T	Time of one cycle	
2-2	time constant of an exponentially varying quantity	τ	Time after which the quantity would reach its limit if it maintained its initial rate of variation	If a quantity is a function of time given by $F(t) = A + Be^{-t/\tau}$ then τ is the time constant.
2-3.1	frequency	f, ν	$f = 1/T$	
2-3.2	rotational frequency	n	Number of revolutions divided by time	
2-4	angular frequency, pulsatance	ω	$\omega = 2\pi f$	
2-5	wavelength	λ	Distance in the direction of propagation of a periodic wave between two successive points where at a given time the phase is the same	

Units **PERIODIC AND RELATED PHENOMENA**

Item No.	**Name of unit**	**International symbol for unit**	**Definition**	**Conversion factors and remarks**
2-1.a	second	s		
2-2.a	second	s		
2-3.a	hertz	Hz	1 Hz = 1 s^{-1}	1 Hz is the frequency of a periodic phenomenon of which the period is 1 s.
2-3.b	reciprocal second, second to the power minus one	s^{-1}		The designations "revolutions per minute" (r/min) and "revolutions per second" (r/s) are widely used for rotational frequency in specifications on rotating machinery. Language-dependent abbreviations, such as the English rev/min and rpm (revolutions per minute) and rev/s and rps (revolutions per second), and the French tr/min (tours par minute) and tr/s (tours par seconde), are not recommended.1)
2-4.a	radian per second	rad/s		See the introduction, subclause 0.3.2.
2-4.b	reciprocal second, second to the power minus one	s^{-1}		
2-5.a	metre	m		ångström (Å), 1 Å = 10^{-10} m (exactly)

1) See also IEC 27-1.

PERIODIC AND RELATED PHENOMENA (*continued*) Quantities

Item No.	Quantity	Symbol	Definition	Remarks
2-6	repetency, wavenumber	σ	$\sigma = 1/\lambda$	The vector quantities $\boldsymbol{\sigma}$ and $\boldsymbol{k}$ corresponding to repetency and angular repetency are called wave vector and propagation vector respectively.
2-7 (*2-6.2*)	angular repetency, angular wavenumber	k	$k = 2\pi\sigma$	
2-8.1 (—)	phase velocity	c, v c_φ, v_φ	$c = \dfrac{\omega}{k} = \lambda f$	If velocities of electromagnetic waves and other velocities are both involved, then c should be used for the former and v for the latter.
2-8.2 (—)	group velocity	c_g, v_g	$c_g = \dfrac{d\omega}{dk}$	
2-9 (*2-7.1*)	level of a field quantity	L_F	$L_F = \ln(F/F_0)$ where F and F_0 represent two amplitudes of the same kind, F_0 being a reference amplitude	If $P/P_0 = (F/F_0)^2$ then $L_P = L_F$. Similar names, symbols and definitions apply to levels based on other quantities which are linear or quadratic functions of the amplitudes, respectively. The quantity on which the level is based should be specified in the name and by the subscript of the symbol, e.g. level of electric field strength L_E. A difference between two field levels with the same reference F_0 is called the field level difference $\Delta L_F = \ln(F_1/F_0) - \ln(F_2/F_0) = \ln(F_1/F_2)$ independent of F_0. An analogous relation applies to power level difference.
2-10 (*2-8.1*)	level of a power quantity	L_P	$L_P = \dfrac{1}{2}\ln(P/P_0)$ where P and P_0 represent two powers, P_0 being a reference power	

Units PERIODIC AND RELATED PHENOMENA (*continued*)

Item No.	Name of unit	International symbol for unit	Definition	Conversion factors and remarks
2-6.a	reciprocal metre, metre to the power minus one	m^{-1}		
2-7.a	radian per metre	rad/m		See the introduction, subclause 0.3.2.
2-7.b	reciprocal metre, metre to the power minus one	m^{-1}		
2-8.a	metre per second	m/s		
2-9.a	neper	Np	1 Np is the level of a field quantity when $\ln(F/F_0) = 1$	See the introduction, subclause 0.5. The decibel, dB, is widely used. Generally $L_F = \ln(F/F_0)$ Np = $2\lg(F/F_0)$ B = $20\lg(F/F_0)$ dB.
2-9.b	bel	B	1 B is the level of a field quantity when $2\lg(F/F_0) = 1$	1 dB = $\frac{\ln 10}{20}$ Np (exactly) = 0,115 129 3 Np
2-10.a	neper	Np	1 Np is the level of a power quantity when $\frac{1}{2}\ln(P/P_0) = 1$	See the introduction, subclause 0.5. The decibel, dB, is widely used. Generally $L_P = \frac{1}{2}\ln(P/P_0)$ Np = $\lg(P/P_0)$ B = $10\lg(P/P_0)$ dB.
2-10.b	bel	B	1 B is the level of a power quantity when $\lg(P/P_0) = 1$	1 dB = $\frac{\ln 10}{20}$ Np (exactly) = 0,115 129 3 Np

PERIODIC AND RELATED PHENOMENA (*concluded*) Quantities

Item No.	Quantity	Symbol	Definition	Remarks
2-11 (*2-9.1*)	damping coefficient	δ	If a quantity is a function of time given by $F(t) = Ae^{-\delta t} \cos[\omega(t - t_0)]$ then δ is the damping coefficient	$\tau = 1/\delta$ is the time constant (relaxation time) of the amplitude. The quantity $\omega(t - t_0)$ is called the phase.
2-12 (*2-10.1*)	logarithmic decrement	Λ	Product of damping coefficient and period	
2-13.1 (*2-11.1*)	attenuation coefficient	α	If a quantity is a function of distance x given by $F(x) = Ae^{-\alpha x} \cos[\beta(x - x_0)]$ then α is the attenuation coefficient and β is the phase coefficient	The quantity $1/\alpha$ is called the attenuation length. The quantity $\beta(x - x_0)$ is called the phase.
2-13.2 (*2-11.2*)	phase coefficient	β		
2-13-3 (*2-11.3*)	propagation coefficient	γ	$\gamma = \alpha + j\beta$	$k' = -j\gamma$ is the complex angular repetency.

Units PERIODIC AND RELATED PHENOMENA (*concluded*)

Item No.	**Name of unit**	**International symbol for unit**	**Definition**	**Conversion factors and remarks**
2-11.a	reciprocal second, second to the power minus one	s^{-1}		
2-11.b	neper per second	Np/s		See the introduction, subclause 0.5.
2-12.a	neper	Np		See the introduction, subclause 0.5.
2-13.a	reciprocal metre, metre to the power minus one	m^{-1}		See the introduction, subclause 0.5. α and β are often given in Np/m and rad/m respectively.

(*Continued from second cover*)

International Standard	*Corresponding Indian Standard*	*Degree of Equivalence*
ISO 31-3 : 1992	IS 1890 (Part 3) : 1995 Quantities and units: Part 3 Mechanics (*second revision*)	Identical
ISO 31-4 : 1992	IS 1890 (Part 4) : 1995 Quantities and units : Part 4 Heat (*second revision*)	Technically Equivalent
ISO 31-5 : 1992	IS 1890 (Part 5) : 1995 Quantities and units: Part 5 Electricity and magnetism (*first revision*)	Identical
ISO 31-6 : 1992	IS 1890 (Part 6) : 1995 Quantities and units : Part 6 Light and related electromagnetic radiations (*first revision*)	Technically Equivalent
ISO 31-7 : 1992	IS 1890 (Part 7) : 1995 Quantities and units: Part 7 Acoustics (*first revision*)	Identical
ISO 31-8 : 1992	IS 1890 (Part 8) : 1995 Quantities and units: Part 8 Physical chemistry and molecular physics (*first revision*)	Identical
ISO 31-9 : 1992	IS 1890 (Part 9) : 1995 Quantities and units: Part 9 Atomic and nuclear physics (*first revision*)	Identical
ISO 31-10 : 1992	IS 1890 (Part 10) : 1995 Quantities and units: Part 10 Nuclear reactions and ionizing radiation (*first revision*)	Identical
ISO 31-11 : 1992	IS 1890 (Part 11) : 1995 Quantities and units: Part 11 Mathematical signs and symbols for use in the physical science and technology (*second revision*)	Identical
ISO 31-12 : 1992	IS 1890 (Part 12) : 1995 Quantities and units: Part 12 Characteristic numbers (*second revision*)	Identical
ISO 31-13 : 1992	IS 1890 (Part 13) : 1995 Quantities and units : Part 13 Solid state physics (*first revision*)	Technically Equivalent

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Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Handbook' and 'Standards Monthly Additions'.

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Amendments Issued Since Publication

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